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Newly Proposed Multi Channel Fiber-Optic Cable Core

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ABSTRACT

Fiber optic cables have single core and multiple core options, but single and multiple core fiber cable 's core design need to be updated. Newly proposed design gives facilities to multiple usage than traditional design of cable core. Cable core design needs improvement by using present technology for decreasing material and cost and by improving efficiency of cable. Research need to be carried out in this direction. What do you think?

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Now have a look on some examples and illustrations for better understanding.

A **fiber-optic cable**, also known as an **optical-fiber cable**, is an assembly similar to an electrical cable, but containing one or more optical fibers that are used to carry light. The optical fiber elements are typically individually coated with plastic layers and contained in a protective tube suitable for the environment where the cable is used. Different types of cable are used for different applications, for example, long distance telecommunication, or providing a high-speed data connection between different parts of a building.

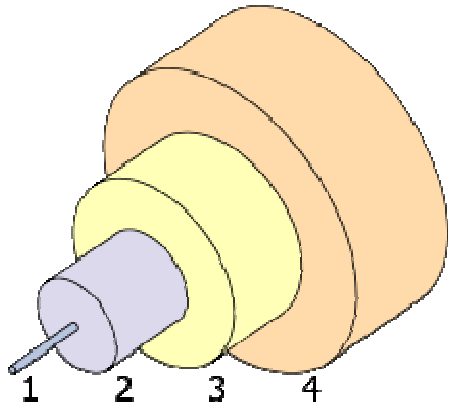
Single-mode optical fiber:

In fiber-optic communication, a **single-mode optical fiber** (**SMF**) is an optical fiber designed to carry only a single mode of light - the transverse mode.

Modes are the possible solutions of the Helmholtz equation for waves, which is obtained by combining Maxwell's equations and the boundary conditions. These modes define the way the wave travels through space, i.e. how the wave is distributed in space.

Waves can have the same mode but have different frequencies. This is the case in single-mode fibers, where we can have waves with different frequencies, but of the same mode, which means that they are distributed in space in the same way, and that gives us a single ray of light.

Although the ray travels parallel to the length of the fiber, it is often called transverse mode since its electromagnetic oscillations occur perpendicular (transverse) to the length of the fiber. The 2009 Nobel Prize in Physics was awarded to Charles K. Kao for his theoretical work on the single-mode optical fiber. The standards G.652 and G.657 define the most widely used forms of single-mode optical fiber.



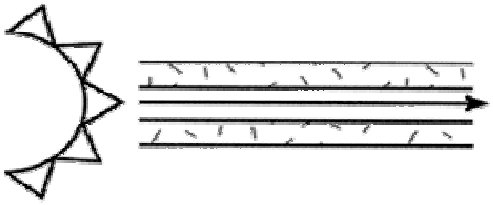
The structure of a typical single-mode fiber
1. Core 8–9 µm diameter
2. Cladding 125 µm diameter
3. Buffer 250 µm diameter
4. Jacket 900 µm diameter

Single Modem fiber is used in many applications where data is sent at multi-frequency (WDM Wave-Division-Multiplexing) so only one cable is needed - (single-mode on one single fiber)

Single-mode fiber gives you a higher transmission rate and up to 50 times more distance than multimode, but it also costs more. Single-mode fiber has a much smaller core than multimode. The small core and single light-wave virtually eliminate any distortion that could result from overlapping light pulses, providing the least signal attenuation and the highest transmission speeds of any fiber cable type.

Single-mode optical fiber is an optical fiber in which only the lowest order bound mode can propagate at the wavelength of interest typically 1300 to 1320nm.

"Single mode fiber"
single path through the fiber



Multi-mode optical fiber:

Multi-mode optical fiber is a type of optical fiber mostly used for communication over short distances, such as within a building or on a campus. Multi-mode links can be used for data rates up to 100 Gbit/s. Multi-mode fiber has a fairly large core diameter that enables multiple light modes to be propagated and limits the maximum length of a transmission link because of modal dispersion.

The standard G.651.1 defines the most widely used forms of multi-mode optical fiber.

Optical fiber consists of a core and a cladding layer, selected for total internal reflection due to the difference in the refractive index between the two. In practical fibers, the cladding is usually coated with a layer of acrylate polymer or polyimide.

This coating protects the fiber from damage but does not contribute to its optical waveguide properties. Individual coated fibers (or fibers formed into ribbons or bundles) then have a tough resin buffer layer or core tube(s) extruded around them to form the cable core.

Several layers of protective sheathing, depending on the application, are added to form the cable. Rigid fiber assemblies sometimes put light-absorbing ("dark") glass between the fibers, to prevent light that leaks out of one fiber from entering another. This reduces crosstalk between the fibers, or reduces flare in fiber bundle imaging applications.

A critical concern in outdoor cabling is to protect the fiber from damage by water. This is accomplished by use of solid barriers such as copper tubes, and water-repellent jelly or water-absorbing powder surrounding the fiber.

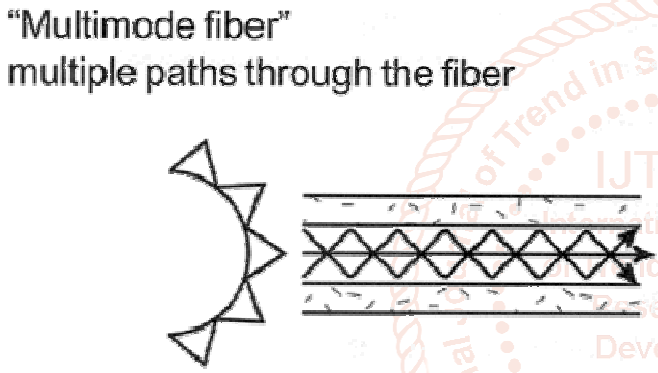
Finally, the cable may be armored to protect it from environmental hazards, such as construction work or gnawing animals. Undersea cables are more heavily armored in their near-shore portions to protect them from boat anchors, fishing gear, and even sharks, which may be attracted to the electrical power that is carried to power amplifiers or repeaters in the cable.

Modern cables come in a wide variety of sheathings and armor, designed for applications such as direct burial in trenches, dual use as power lines, installation in conduit, lashing to aerial telephone poles, submarine installation, and insertion in paved streets.

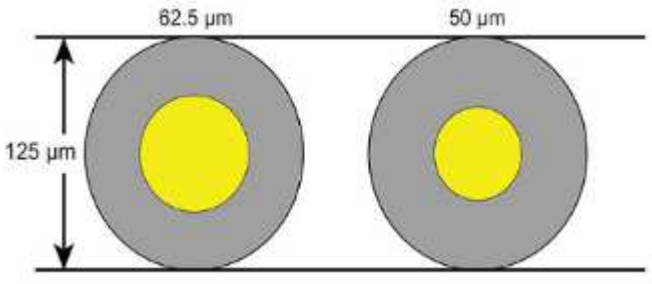
Multi-Mode cable has a little bit bigger diameter, with a common diameters in the 50-to-100 micron

range for the light carry component (in the US the most common size is 62.5um). Most applications in which Multi-mode fiber is used, 2 fibers are used (WDM is not normally used on multi-mode fiber). POF is a newer plastic-based cable which promises performance similar to glass cable on very short runs, but at a lower cost.

Multimode fiber gives you high bandwidth at high speeds (10 to 100MBS - Gigabit to 275m to 2km) over medium distances. Light waves are dispersed into numerous paths, or modes, as they travel through the cable's core typically 850 or 1300nm. Typical multimode fiber core diameters are 50, 62.5, and 100 micrometers. However, in long cable runs (greater than 3000 feet [914] meters), multiple paths of light can cause signal distortion at the receiving end, resulting in an unclear and incomplete data transmission so designers now call for single mode fiber in new applications using Gigabit and beyond.



Multimode fiber (MMF) is a kind of optical fiber commonly used in communication for relatively short distances, for instance, inside buildings or corporate campuses. Multimode fiber optic cable has a larger core, typically 50 or 62.5 microns that enables multiple light rays or modes to be propagated simultaneously. However, the modes tend to disperse over longer lengths that the transmission distance of MMF is limited. The maximum transmission distance for MMF cable is around 550m at 10Git/s. Other typical transmission and distance limits are 2km at the speed of 100Mb/s and 1km at 100Mb/s.



Some examples diagrams of newly introduced core of single and multimode fiber cable:

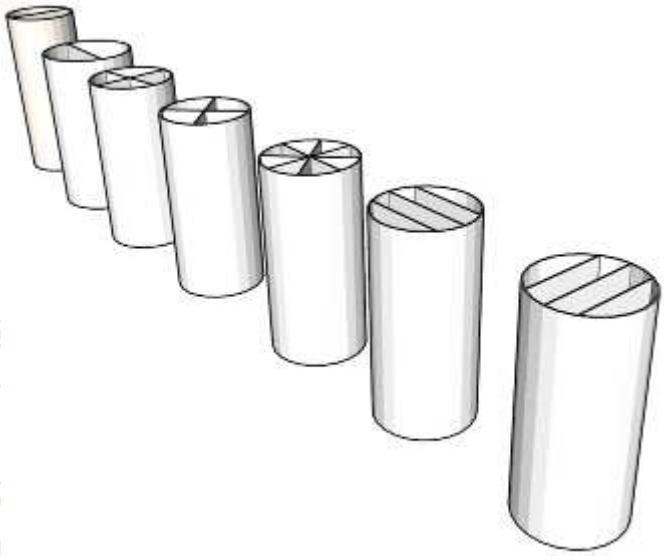


Diagram (A) Prospective view of cable multi channel core:

Diagram (B) Top view of cable multi channel core:

Conclusion:

In general, multimode fiber cable continues to be the most cost-effective choice for enterprise and data center applications. As for whether to choose a single mode fiber or multimode fiber, the applications that you need, transmission distance to be covered as well as the overall budget should be taken into consideration. By introducing new core design cable as shown in fig (A) and (B) cost and material could be saved and could improve efficiency of cable than previous designing methods.